Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	GN Docket No. 17-183
Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz	)	

COMMENTS OF MICROSOFT CORPORATION

Paula Boyd
Senior Director
U.S. Government and Regulatory Affairs

Michael Daum
Director, Technology Policy
Privacy and Regulatory Affairs

Microsoft Corporation
901 K Street, N.W., 11th Floor
Washington, DC 20001

October 2, 2017

TABLE OF CONTENTS

I. SUMMARY

Microsoft Corporation ("Microsoft") submits these comments in response to the Commission's Notice of Inquiry ("NOI") on 'Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz".[1] With this NOI the Commission continues its work to make spectrum available for the next generation wireless broadband networks. We applaud these efforts, believe that the specific bands 3.7-4.2 GHz and 5.925-7.125 GHz ('6 GHz band') offer the best near-term opportunity for expanded flexible broadband use in the mid-bands, and urge the Commission to issue a Notice of Proposed Rule Making (NPRM).

Specifically, Microsoft's believes the Commission should expeditiously issue an NPRM to develop service and technical rules that permit unlicensed operations in the 6 GHz band under its Part 15 rules. Permitting unlicensed operations in the 6 GHz band is critical to meeting growing demand for Wi-Fi, driving innovation and investment, and preserving U.S. leadership. Unlicensed operations are ideal for allowing greatly expanded use of the 6 GHz band, while protecting existing users. The Commission's proposed technical rules should be consistent with those in the U-NII-1 and U-NII-3 bands to the greatest extent possible to maximize utility and promote economies of scale.

The Commission's NPRM should also include proposed rules to extend the CBRS to 3.8 GHz and create a new fixed wireless broadband service between 3.8-4.2 GHz to provide another tool for closing the rural broadband divide. Finally, Microsoft proposes that the Commission allow for an equivalently protective Channel Availability Check procedure to increase the

[1] *Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz*, GN Docket No. 17-183, Notice of Inquiry, FCC 17-104 (rel. August 3, 2017) ("NOI")

utilization of 5 GHz sub-bands requiring Dynamic Frequency Selection by low power consumer devices.

II. THE 3.7-4.2 GHz BAND

A. The 3.7 – 4.2 GHz Band is Severely Underutilized

The Fixed Satellite Service (FSS) downlinks operating in the 3.7-4.2 MHz portion of the C-band still provide useful commercial service, even in light of the growth in higher capacity satellites operating in the millimeter wave bands. The issue is that these FSS downlinks make inefficient use of its licensed spectrum in a way that also limits spectrum sharing. The root of the inefficiency is the existing "full band, full arc" coordination policy that is several decades old. If the Commission goes forward with a Mid-Band Spectrum Notice of Proposed Rule Making (NPRM), it should initiate a process to update its rules regarding FSS earth stations so that they are protected only to the extent necessary to protect them from receiving harmful interference.

Additionally, it has become evident over the course of the record developed this year in two related proceedings[2] that the Commission's licensing database could benefit from updating FSS licensing information. According to the BAC Petition: "There is overwhelming evidence that many of the licensed FSS earth stations were never built, no longer exist, or operate at locations far removed from those for which they were licensed."[3]

---

[2] Petition of the Fixed Wireless Communications Coalition, Inc., Request for Modified Coordination Procedures in Bands Shared Between the Fixed Service and the Fixed Satellite Service Petition for Rulemaking, RM-11778, at 1-7 (filed Oct. 11, 2016) ("FWCC Petition").
Petition of the Broadband Access Coalition ("BAC") for a Rulemaking to Amend and Modernize Parts 25 and 101 of the Commission's Rules to Authorize and Facilitate the Deployment of Licensed Point-to-Multipoint Fixed Wireless Broadband Service in the 3700-4200 MHz Band, Petition for Rulemaking, RM-11791, at 16-17, 21-24 (filed June 21, 2017) ("BAC Petition").

[3] See BAC Petition at 22.

While the Commission takes steps to improve the coordination process and update FSS licensing information, it should propose a sharing framework between FSS and various new services that will increase spectrum utilization across the band and, more importantly, benefit the public by making more spectrum available for broadband connectivity and broadband capacity.

B. The Commission Should Extend the Citizens Broadband Radio Service to 3.8 GHz

In April 2015, the Commission's '3.5 GHz Order' authorized the Citizens Broadband Radio Service (CBRS) between the frequencies 3.550 and 3.700 GHz and adopted a three-tier authorization framework managed in near real time by a software-based Spectrum Access System (SAS).[4]

The highest tier in this framework consists of 'protected incumbents,' which include federal users, FSS earth stations, and until April 17, 2020, Grandfathered Wireless Broadband Licensees operating in the 3.650-3.700 GHz band. The middle tier consists of Priority Access Licensees (PALs) that cannot cause harmful interference to 'protected incumbents' and must accept interference from them. The lowest tier is for unlicensed-like General Authorized Access (GAA) use. GAA users cannot cause harmful interference to any higher-tier operations and cannot claim protection from interference from other CBRS users. The SAS provides spectrum access to both PAL and GAA users. Additionally, the Commission's use-or-share rules permit GAA users to access frequencies assigned to PALs when the SAS determines that such frequencies are not in use.

[4] *See* Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band, GN Docket No. 12-354, Report and Order and Second Further Notice of Proposed Rulemaking, 30 FCC Rcd 3959 (2015) (3.5 GHz Order).

Under the Commission Part 96 rules, a maximum of 70 megahertz of spectrum in the CBRS band may be reserved for PALs in any given license area at any time, with the remainder of the available frequencies made available for GAA use.[5] While there isn't a completed band plan, the Commission reserved the 3.650-3.700 GHz band for GAA users and Grandfathered Wireless Broadband Licensees, who will have to protect FSS earth stations. In the 3.550-3.650 GHz band, PAL and GAA users will have to protect federal incumbents. While the Commission declined to subdivide the 3.550-3.650 GHz band between PAL and GAA users, it encouraged industry to come to an agreement on a common band plan, "so long as the band plan complies with the rules".[6] Microsoft's expectation is that in most licensing areas, PALs will operate on the lowest seven channels in the 3.550-3.650 GHz range.

Globally, Microsoft's customers increasingly access our cloud-based services over wireless devices – over licensed spectrum, unlicensed spectrum, and a combination of the two. Consequently, our interests in spectrum policy are global. We note that in many parts of the world, 3.400-3.800 GHz is being made available for licensed mobile use. We recognize the band is going to be used for both licensed and unlicensed LTE service and there is an opportunity to leverage global economies of scale for some of the hardware, even though access to the spectrum will be managed by software in the U.S.

With this in mind, we believe that the Commission should expand the CBRS band to 3.800 GHz. The additional 100 MHz of channels should be for GAA use, with a channel size of 20 MHz. Carrier aggregation of licensed blocks of spectrum, as well as aggregation of licensed and unlicensed spectrum, is central to Mobile Network Operators' (MNO) network strategy. By

[5] *See id*. at ¶ 63.
[6] *See id*. at ¶59.

default, the GAA spectrum for small cell use will be unlicensed LTE as IEEE decided not to amend or develop a WLAN standard for the CBRS[7]. MNOs and other licensees will have the ability to aggregate PAL and GAA spectrum so there would be no need for the Commission to additionally authorize PALs in the 3.700-3.800 GHz band. GAA will achieve the same ends at lower cost.

Microsoft recognizes there are many details that will have to be worked through to extend the CBRS to 3.800 GHz. If the Commission does release an NPRM or Public Notice to amend CBRS technical and services rules, it should propose extending the upper frequency of the CBRS band to 3.800 GHz.

C. The Commission Should Authorize a New Licensed Fixed Wireless Service in the 3800-4200 MHz Frequency Band

Recently, Microsoft called for a new strategy on rural broadband connectivity.[8] The Commission's most recent Broadband Progress Report[9] found that approximately 34 million Americans lack access to broadband.[10] Over 23 million of these Americans reside in rural areas, representing 39 percent of the rural population. On Tribal lands, over 40 percent of the population lacks access to broadband service, with the percentage increasing to over two-thirds in rural Tribal lands.[11]

---

[7] See Comments of the Institute of Electrical and Electronic Engineers (IEEE) in Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band, GN Docket No. 12-354, Second Further Notice of Proposed Rulemaking, 30 FCC Rcd 3959 (2015) (dated July 13, 2015).

[8] *See* Microsoft calls for U.S. Strategy to eliminate rural broadband gap within 5 years (July 10, 2017), *available at* < https://news.microsoft.com/rural-broadband/>.

[9] *In the matter of Inquiry Concerning the Deployment if Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, as Amended by the Broadband Data Improvement Act*, GN Docket No. 15-191, 2016 Broadband Progress Report, 31 FCC Rcd 699 at ¶ 731.

[10] The Commission defines fixed broadband as 25 Megabits per second (Mbps) downstream speed and 3 Mbps upstream speed.

[11] *In the matter of Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, as Amended by the Broadband Data Improvement Act*, GN

We believe a technology model that uses a combination of the TV white spaces spectrum, satellite coverage, and other fixed wireless frequencies, depending on population density, can significantly reduce the initial capital costs and on-going operating costs of providing affordable last mile broadband coverage to rural America.

To these ends, we believe that the Commission should issue a Notice of Proposed Rule Making (NPRM) to authorize a new licensed fixed point-to-multi point (P2MP) wireless service in the 3.800-4.200 GHz frequency band. Such a P2MP service offers the potential to be part of last-mile broadband access solutions in less densely populated areas.

Additionally, the availability of a new fixed wireless broadband service has the potential to introduce competition for broadband access in places where there is one only provider. According to the Commission, only 42 percent of developed census blocks[12] in the U.S. have access to two or more providers offering fixed broadband[13]. As described in the report, the fact that broadband service is offered in a developed census block does not mean the service is offered at that speed to all locations in the developed census block or for that matter, broadband is offered to all locations in the developed census block. By technology, 82.6 percent of developed census blocks where there are fixed connections at least 25 Mbps downstream and 3 Mbps upstream is cable modem.[14] Competition will increase choices for consumers and lead to increased broadband uptake. If the price of broadband access is not affordable to those living in less densely populated areas, then it is not truly available. And certainly, nothing would prevent the new fixed wireless service from being used in more densely populated areas for backhaul.

Docket No.15-191, *2016 Broadband Progress Report*, 31 FCC Rcd 699 (2016) at ¶731.

[12] Census block that contains housing units.

[13] *See* "Internet Access Services: Status as of June 30, 2016", Industry Analysis and Technology Division Wireline Competition Bureau (April 2017), at Figure 4.

[14] Id. at Figure 22.

While we believe that the Commission should issue an NPRM that authorizes a new fixed service, it should do so in a manner that doesn't preclude the authorization of licensed or GAA - like mobile operations at some later date. If licensed 5G mobile use in the millimeter bands does not go as planned, e.g. as a result of much larger than anticipated infrastructure costs or the inability to create dense networks (due to the inability to access public and private property to place small cells everywhere necessary), MNOs may have to look to the 3.8-4.2 GHz band to support 5G capabilities. With respect to unlicensed-like use, the IEEE chose not to develop new- or modify existing WLAN standards for the CBRS band. If the Commission proposes rules that would not prevent future GAA (licensed-by-rule) access across the 3.800-4.200 GHz band, the IEEE may want to consider this frequency range.

Microsoft agrees with the overall contour of the Broadband Access Coalition (BAC) petition to the Commission but differs on a number of the details.[15] We differ on the size of the band for P2MP broadband. From our standpoint, the 3.800-4.200 GHz band offers a significant amount of contiguous spectrum that allows for concurrent operation of up to five - 80 MHz channels; two – 160 MHz channels and one – 80 MHz channel; or a larger number of smaller channels. By happenstance, these channel sizes also would accommodate Wi-Fi use. We agree with the BAC petition that the Commission should allow P2MP licensees to bond channels to increase the available bandwidth. We also agree that the Commission should require devices to be operable across the spectrum band.

One reason the 3.800-4.200 GHz frequency band is attractive for a new fixed P2MP broadband service is that there are no Federal government users in the band. There are incumbent

[15] *See* BAC Petition

FS and FSS users in the band and new fixed broadband service will have to share spectrum with these incumbents and not cause them harmful interference. For this reason, Microsoft supports a maximum EIRP of 50 dBm for licensed P2MP operations as a starting point for further discussion. In this frequency range, the radiated power at the base station must be sufficient to deliver a broadband signal over a long distance in less densely populated areas.

We appreciate the simple and proven mechanism proposed under Part 101 of the Commission's rules to coordinate the various users and services in the band. This method will allow the new fixed broadband service to be initiated immediately. However, we believe that the Commission should require the coordination process to be automated through a database in relatively short order after the new service is authorized through a multi-stakeholder process, including FSS operators, and with a date certain transition. If only fixed links and FSS earth stations need to be protected, constructing such a database would be considerably less complicated than that required for a SAS in the CBRS band. Having such a database would also provide the foundation for licensed mobile or GAA operations to share the 3.800-4.200 GHz frequency band if the Commission decides to take such action in the future.

III. THE 5.925-7.125 GHz ('6 GHz') BAND

A. The Commission should expeditiously issue a Notice of Proposed Rulemaking to develop service and technical rules that permit unlicensed broadband operations in the 6 GHz band

Microsoft contributed to joint comments filed by a group of companies and organizations who believe that: "This Notice of Inquiry presents an important opportunity to address the nation's clear need for additional unlicensed frequencies. As a next step, the Commission should

expeditiously issue a Notice of Proposed Rulemaking to develop service and technical rules that permit unlicensed broadband operations in the 6 GHz band."[16]

To summarize Microsoft believes that:

- Permitting unlicensed operations in the 6 GHz band is critical to meeting growing demand for Wi-Fi, driving innovation and investment, and preserving U.S. leadership.
    - The 6 GHz band supports multiple 80- and 160 MHz IEEE 802.11ax compliant channels, each of which can support speeds greater than 1 Gbps.
    - The 6 GHz band has a mobile allocation throughout the band.
    - The 6 GHz band allows indoor / outdoor use.
    - The 6 GHz band allows for penetration of one or two indoor walls.
    - The 6 GHz band allows Wi-Fi chip manufacturers and equipment providers the ability to leverage the existing 5 GHz band Wi-Fi infrastructure.
    - The mitigation techniques available to protect incumbents are not prohibitively difficult nor expensive to implement, particularly for consumer devices.
- The 'unlicensed community' appreciates the Commission's actions to extend the 60 GHz band to 71 GHz, but notes that additional high-band 60 GHz spectrum is not a direct substitute for making additional mid-band spectrum available for Wi-Fi as many of the use cases are different and radio waves at these frequencies can't penetrate walls at power levels acceptable for consumer and enterprise client devices.

[16] Joint Comments of All Points Broadband, Amplex Internet, Apple, Blaze Broadband, Broadcom, Cambium Networks, Cisco Systems, Cypress Semiconductor, Dell Inc., Extreme Networks, Facebook, Fire2Wire, Google, Hewlett-Packard Enterprise, HP, Intel, , Joink, MediaTek, MetaLINK Technologies, Microsoft, New Wave Net, Pixius Communications, Qualcomm, Rise Broadband, Ruckus, a unit of Brocade, Snappy Internet, Sony Electronics, Western Broadband, Wireless Internet Service Provider Association, and Wisper ISP.

- Unlicensed services are ideal for allowing greatly expanded use of the 6 GHz band, while protecting existing users.
    - Microsoft champions the idea that the Commission should propose making the entire 5.925-7.125 GHz frequency range available for unlicensed use.
    - Unlicensed broadband operations would complement existing services in the 6 GHz band because unlicensed operations could neither prevent incumbents from expanding their operations, nor impose additional restrictions on new deployments.
    - If part of the 6 GHz band is licensed, each licensee is entitled to protection from harmful interference and must be coordinated with other licensees before new operations are permitted. Therefore, the addition of an entirely new class of licensees in the band would further increase the burdens faced by existing 6 GHz service licensees and would likely impose additional restrictions on new deployments and modifications of existing deployments.
    - Unlicensed services have an extensive track record of sharing with a wide range of incumbent users, and the mitigation measures included in the Commission's Part 15 rules serve as a solid base of potential protection measures that will ensure that existing users and their operations will be protected.
    - There are no federal incumbents.
- Unlicensed designations best support innovation and growth when the FCC adopts pro-investment rules and provides large blocks of contiguous frequencies.
- The Commission should adopt technical rules consistent with those in the 5 GHz band in order to maximize utility and promote economies of scale.

- Similar to its approach in the 5 GHz band, where it created several Unlicensed National Information Infrastructure (U-NII) sub-bands based on the protection requirements of the incumbents in each sub-band, the Commission should create sub-bands within the 6 GHz band based on the protection requirements of the incumbents.
- Based on the incumbent service, the NPRM could propose the following four sub-bands:
    - U-NII-5: 5.925-6.425 GHz
    - U-NII-6: 6.425-6.525 GHz
    - U-NII-7: 6.525-6.875 GHz
    - U-NII-8: 6.875-7.125 GHz
- The NPRM should seek comment on a range of mitigation options to allow unlicensed broadband use while protecting incumbents. The optimal solution, however, may be to employ different combinations of coexistence techniques in different 6 GHz sub-bands rather than take a least common denominator approach across all bands.
- The NPRM should seek comment regarding the applicability of the U-NII-1 and U-NII-3 band technical rules to U-NII-5 through U-NII-8.

- The Commission should require correct registration data from 6 GHz licensees.
    - There is a belief that the registration data for FSS uplinks operating in the 6 GHz band may suffer from the same shortcomings as does registration data for FSS downlinks operating in the 3.7-4.2 GHz band.

IV. AMENDING THE COMMISSION'S RULES TO IMPROVE UTILIZATION OF THE 5GHz FREQUENCY BANDS REQUIRING DYNAMIC FREQUENCY SELECTION

The Commission put in place rules for U-NII devices to share spectrum with incumbent services in the 5.150-5.250 GHz (U-NII-1), 5.250-5.350 GHz (U-NII-2A), 5.470-5.725 GHz (U-

NII-2C), and 5.725-5.825 GHz (U-NII-3) bands, collectively referred to as the 5 GHz band, under different rules for each sub-band, depending on protection requirements of incumbent services. The Commission requires U-NII operations in U-NII 2A and U-NII 2C sub-bands use Dynamic Frequency Selection (DFS) and Transmit Power Control (TPC)[17] to protect incumbent radar operations.[18]

For over a decade, Wi-Fi devices employing DFS and TPC (where applicable) have successfully co-existed with radar systems in the U-NII-2A and U-NII-2C bands. Yet, as the Commission notes the most active use in the 5 GHz band appears to be in those sub-bands not subject to DFS requirements[19]. The NOI asks several questions regarding the U-NII industry's experience in deploying equipment with DFS, including whether DFS is providing meaningful access to spectrum.[20]

Microsoft is a member of the Wi-Fi Alliance® (WFA).[21] We participated in the WFA's review of its members' use of the DFS bands. The top three issues identified by WFA members as contributing to lighter use of the sub-bands in which DFS requirements are required are:[22]

- The DFS mechanism limits certain type of applications;
- It adds complexity in designing and producing equipment with DFS capabilities; and
- Additional time is needed to obtain equipment approval for products using DFS bands.

[17] 47 C.F.R § 15.407(h)(1) – A TPC mechanism is not required for systems with an e.i.r.p, of less than 500mW.
[18] 47 C.F.R § 15.407(h)(2).
[19] *See* NOI at ¶ 30.
[20] *Ibid.*
[21] Wi-Fi Alliance® is the worldwide network of companies that defines standards-based Wi-Fi technologies and programs, certifies products that meet quality, performance, security, and capability standards, provides industry thought leadership, and advocates globally for fair spectrum rules.
[22] The Wi-Fi Alliance's Comment in response to this NOI will discuss these issues in greater detail

An example of this is Microsoft's Xbox One gaming console which is a consumer device that can operate across the U-NII bands and incorporates a DFS radar detection mechanism. The Xbox One can access the Internet either through a wireline or wireless connection. If the Xbox One's network connection is over wireline, the console serves as a U-NII master device for its accessories (clients) such as a wireless game controller. If the Xbox One's network connection is over wireless, it must communicate with a Wi-Fi access point (AP) attached to the endpoint of the fixed broadband connection entering the residence. The console then can also serve as U-NII master device for its accessories but transmits using frequencies in a different U-NII band. For example, if the Xbox One's network connection utilizes the U-NII-1 band, then the Xbox One console selects channels in the U-NII-3 band to communicate with its accessories. Similarly, if the network connection is over the U-NII-3 band, the link between the console and the wireless game controller will use the U-NII-1 band. To the extent that there are consumer Wi-Fi APs able to access DFS frequencies, the Xbox One can utilize the U-NII-2A or U-NII-2C bands for its network connection.

The more pressing challenge regarding use of the DFS mechanism is ensuring the communications between the Xbox One console operating in the master mode and the wireless game controller (and other accessories) operating in the client mode can provide a good user experience.

As the DFS bands are more rarely used, particularly in a residential setting, the potential benefits to the consumer are an extremely quiet media space resulting in the best possible latency, range, and throughput for their wireless connections. This is exactly the connection desired for human interface devices used for gaming where responsiveness in the single digit millisecond range is desired.

A. Xbox One Wireless Communications Between the Console and Controller are Low-Power and Intended for Indoor Use

The Xbox One is intended for indoor use. The console has an attached AC power cord. On most models, the console top incorporates a pattern of small openings into the cover design to help ensure the internal electronics do not overheat. In these cases, the cover design also serves as a natural inhibitor to outdoor applications.

The current Xbox One models incorporate separate radios that operate in the 2.4 GHz, U-NII-1, and U- NII-3 bands for the network connection. These radios can also be used for communications between the Xbox One console and wireless controller(s). The 2.4 GHz radio is included because in some countries, use of the U-NII-1 and / or U-NII-3 frequencies may not be authorized. Through a firmware update, the existing range of existing U-NII-1 radios could be extended to cover the entire 5.150-5.350 GHz range and the range of existing U-NII-3 radios could be extended to cover the entire 5.470-5.825 GHz range.

The console's 5 GHz radios are designed to interact and communicate with a human operator holding a low-power wireless controller within a residential structure, most likely in the same room. This typically means that the console's radiated energy is directed to the core of a residential building rather than presenting to an outside wall. A Faraday cage immediately backing the antenna structure limits energy spray toward the back of the host console or outside wall. The maximum power of the communication link between console and wireless controller is limited to 10 mW e.i.r.p. The wireless controller incorporates a U-NII-1 and U-NII-3 band radios, each with a maximum power of 10 mW. A front facing hemispherical antenna is used with a gain of less than 6 dBi to direct the controller signal towards the console.

B. Challenges for the Xbox One to Utilize the DFS Bands

Under the rules, when operating in these frequency bands, operators can only use equipment with the DFS mechanism turned on. Wi-Fi APs usually require setup just once during installation and stay powered on indefinitely. If the Wi-Fi AP is set for the U-NII-2A or U-NII-2C DFS spectrum bands, these frequencies would be available for the DFS enabled Xbox One network connection after successfully completing the Channel Availability Check (CAC). Here the Wi-Fi AP can dedicate 100 percent of its time performing the CAC because it does not have any client devices paired to it.

As it also serves as a master device, once the Xbox One is powered up and prior to the start of any transmission to complete the network connection over a spectrum band requiring DFS, it must monitor the radio frequency environment for the presence of a radar signal. The Xbox One would be able to transmit on the channel if no radar signal with a power level greater than -64 dBm[23] is detected within 60 seconds.

When the Xbox One is powered up, it will also also try and establish a connection with the wireless controller(s) on a non-DFS channel and agree on a sequence of channels to use based on their relative quality, such as how noisy they are. Hypothetically, if the Xbox One identifies a DFS channel for console-to-game controller communications, it would only be able to start using the channel in the DFS band if no radar signal greater than -62 dBm[24] is detected within 60 seconds.

[23] 47 C.F.R §15.407(h)(2) (Minimum DFS detection threshold for devices with a maximum e.i.r.p of 200 mW and a power spectral density of less than 10 dBm is a 1 MHz band).
[24] 47 C.F.R §15.407(h)(2) (Minimum DFS detection threshold for devices with a maximum e.i.r.p of 200 mW to 1W.)

If the Xbox One detects the presence of a known radar signature, it is required to select another channel. The CAC process is repeated until either a channel is found without a radar signature or the device enters a sleep mode if no channels are available. In-service monitoring for known radar signatures on the transmission channel is also required. A channel that has been identified as being occupied by a radar system either through the CAC or in-service monitoring, cannot be occupied for at least 30 minutes.

From the time the Xbox One powers up, the minimum amount of time required to utilize the DFS spectrum for controller-to-console communications is 60 seconds. For argument sake, assume the first channel in the agreed upon list is in the non-DFS bands and the second channel on the list is in the DFS band. Due to other users in an apartment building, the first channel starts becoming a little noisy to where the Xbox One wants to move to the next channel on its agreed list. The challenge is that during the CAC process, the master (Xbox One) device is unavailable to respond to client device requests. The Xbox One master would have to drop the client device (wireless game controller) to perform the CAC, so that possibly in a minute, it can reconnect with the client device on a quieter DFS channel.

Including the Xbox One, there are certain classes of latency sensitive wireless devices that cannot allow long disruptions in client service. Devices which must remain connected and responsive on a non-DFS channel during the CAC will not typically employ an independent radio to support the entry to DFS channels – unfortunately losing the opportunity to work in this beneficial media space. And while employing an independent radio (or two) to support entry to DFS channels is technically possible, the solution increases costs to the point that it becomes too expensive to implement in consumer devices.

C. In Any Mid-Band Rulemaking the Commission Should Propose an Enhanced Channel Availability Check Framework for Low Power Master Devices

Microsoft proposes that the Commission consider a new enhanced CAC to maintain uninterrupted service between a latency-sensitive low-power (e.g., 10 mW e.i.r.p.) master and its client devices while concurrently meeting regulatory detection probability requirements on the DFS channels. We have developed an alternative and equivalent means for achieving the required minimum probability of detection and average detection probability for the required radar wave forms and validated our approach through simulation.

In general, Microsoft proposes that the master device be allowed to momentarily check status of the client(s) and spend the bulk of time doing a CAC on a duty cycle basis extended to at least 15 minutes from the time the Xbox One is powered up. As long as there is no client activity, the enhanced CAC can continue for an extended period – increasing the probability and accuracy in detecting radar events. The occurrence of either radar detection or a client event such as a button press on the controller would abort the CAC scan allowing client devices to remain connected in a non-DFS channel available for human interface events such as additional button presses on the controller.

Initially, the master device transmits a beacon on a non-DFS channel and listens for connection requests from a client device for 5 milliseconds (ms). If the master device does not detect a connection request from a client device within the 5 ms after transmitting the beacon, the master device will switch over to a DFS channel within 1ms and perform CAC for the remaining 93 milliseconds. After 93 milliseconds of CAC, the master device will switch over to a non-DFS channel within 1 millisecond and start beaconing again. This process is repeated over the 100 milliseconds time frame and is referred to as 93 percent duty cycle CAC. The 93 percent duty

cycle CAC is performed within the extended CAC duration of 15 minutes instead of 60 seconds to assess the presence of radar on a DFS channel.

Microsoft believes in this instance radar detection will be more reliable if the CAC duration is increased from 60 seconds to 15 minutes especially for weather radars due to the long scanning interval. If there is an interruption from a client device within the CAC duration, the master device will abort the CAC process and service the client device on the non-DFS channel. If there is no interruption from a client device (via connection requests) during the CAC duration, the master will continue to perform CAC. If the CAC process clears the channel for the presence of radar, the master device will occupy the DFS channel and begin the in-service monitoring process. During in-service monitoring, the master device will begin to transmit beacons every 100 milliseconds (on the DFS channel) and switch to receiver mode to listen for connection requests from the client device and at the same time detect radar. The master device is still able to monitor for radar when it is in receiver mode. If the master device detects radar during in-service monitoring, it will communicate to the client device(s) to vacate the DFS channel and move to a non-DFS channel.

We simulated how well our approach works in detecting each of the FCC's radar wave forms. Under the current test procedures, for each of radar wave forms 0 through 4, the minimum probability of detection for the U-NII device is 60 percent, and the average detection probability must be at least 80 percent. For radar wave form 5, the minimum probability of detection is 80 percent. For the FCC frequency hopping radar waveform, the minimum probability of detection is 70 percent. In every case, our 93 percent duty cycle CAC approach met or exceed these requirements.

Microsoft intends to file a waiver request to 47 CFR 15.407 (h)(2)(ii) separately. Additionally, we propose that if the Commission issues a Mid-Band Spectrum Notice of Proposed Rulemaking, it proposes to amend subparagraph 47 CFR 15.407 (h)(2)(ii) as follow:

> (ii) *Channel Availability Check Time*. A U-NII device shall check if there is a radar system already operating on the channel before it can initiate a transmission on a channel and when it has to move to a new channel. The U-NII device may start using the channel if no radar signal with a power level greater than the interference threshold values listed in paragraph (h)(2) of this section, is detected <u>either</u> within 60 seconds <u>or under any alternative approach the Commission determines provides an equivalent probability of detection for all FCC simulated DFS radar signals</u>.

V CONCLUSION

Microsoft applauds the Commission for opening an inquiry into expanding flexible use in 'Mid-Band Spectrum between 3.7 and 24 GHz. Achieving flexible use requires spectrum sharing – between new licensed services with incumbents and between new unlicensed services with incumbents. Depending on the incumbent services that need to be protected in a frequency band, the spectrum sharing may be achieved through several different mechanisms – some more simple and others more complex.

Specifically, Microsoft proposes that the Commission moves forward with a Notice of Proposed Rule Making to: (1) extend the CBRS to 3.800 GHz; (2) authorize a new fixed wireless broadband service from 3.800-4.200 GHz; and (3) authorize unlicensed operations across the entire 5.925-7.125 GHz frequency band under Part 15 of its rules. In addition, Microsoft believes

that the Commission can increase the utility of DFS bands for low-power consumer devices by allowing use of an equivalent method for performing the Channel Access Check.

Respectfully submitted,

/s/ Paula Boyd
Paula Boyd
Senior Director, Govt. and Regulatory Affairs

Michael Daum
Director, Technology Policy, Privacy and Regulatory Affairs

MICROSOFT CORPORATION
901 K Street NW, 11th Floor
Washington, DC 20001
(202) 263-5900

October 2, 2017